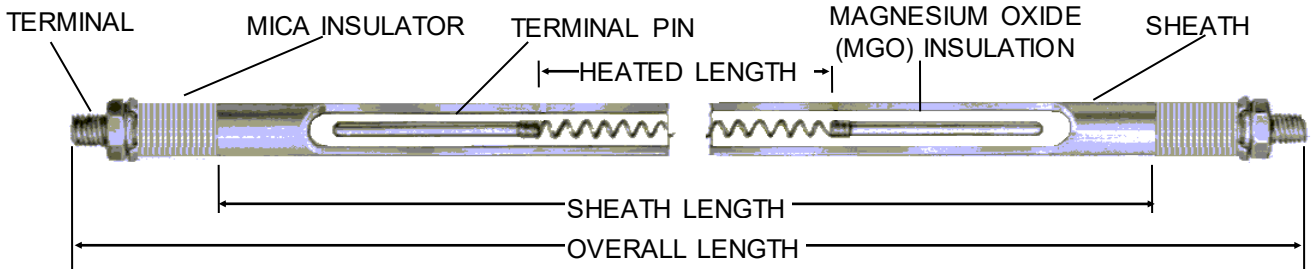
Introduction to Tubular Heaters

TECHNICAL INFORMATION



GENERAL INFORMATION

Akinsun's electric line of tubular heaters is the most versatile of all heating elements. They can be used in straight or formatted configurations. Since most tubular are designed for specific applications, this portion of the catalog will serve as a guide for your particular design. Because of their flexibility in design they can be used for heating liquids, gas, radiant heaters, for casing into aluminum, bronze or iron.

CONSTRUCTION

Akinsun tubular heaters are made from the highest quality materials under carefully researched manufacturing methods. The nickel chromium resistances wire coil is precisely centered in the tube and packed with high purity magnesium oxide (Mgo). After the tube is filled with Mgo, it is compacted by rolling or swaging. This elongates the tube, thickens the wire and compresses the Mgo into a rock hard mass. This process permanently stabilizes the coil in the center of the tube where it will not shift during the forming process.

SHEATH MATERIAL	MAX. SHEATH TEMP.	MAX WATTS PER SQ. IN	RECOMMENDED APPLICATION
COPPER	*350°F (165°C)*	*55*	*Water, non-corrosive liquids*
STEEL	*750°F (385°C)*	*22*	*Oil immersion, Cast-in*
STAINLESS	*1200°F(635°C)*	*30*	*Corrosive liquids, Food processing*
INCOLOY	*1600°F(850°C)*	*40*	*Corrosive liquids, Air, Clamp-on*

PHYSICAL LIMITATIONS AND ELECTRICAL DATA				
SHEATH DIA ± .005	*.260*	*.315*	*.375*	*.430*
SHEATH MINIMUM	*11½"*	*11½"*	*11½"*	*11½"*
LENGTH MAXIMUM	*84"*	*200"*	*230"*	*255"*
MAX. AMPERAGE	*15*	*30*	*30*	*40*
MAX. VOLTAGE	*250*	*300*	*480*	*550*
THREAD SIZE	*6-32*	*8-32*	*10-32*	*10-32*

STANDARD LENGTH TOLERANCES			
SHEATH LENGTH	*SHEATH LGH. TOLERANCE*	*HEATED LGH. TOLERANCE*	*MINIMUM COLD ENDS*
Up to 20"	*±1/16"*	*±2%*	*1"*
20 to 100"	*±1/18"*	*±2%*	*1½"*
100 to 200"	*±1/4"*	*±2%*	*2½"*

Technical Information

Features

AKINSUN tubular heaters are made of highest quality material selection and construction techniques. This enables a maximum allowable heat output without sacrificing life.

Economical

Tubular heaters emit infrared energy. The energy that is most easily absorbed by a mass and converted to heat. The energy goes directly into your product. It does not have to heat a lot of air first. AKINSUN heaters provide the most economical solution to hundreds of heating applications.

Versatility

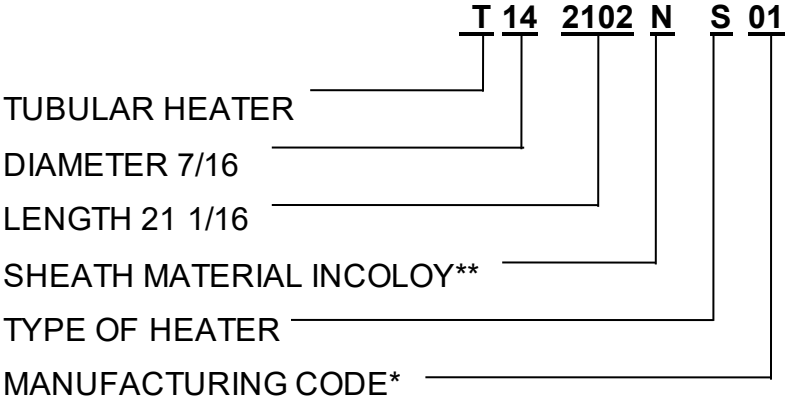
- Made to .260, .315, .375 and .430 diameters
- Several standard up to 3-5 bend configurations
- 4 Sheath materials to choose from

Performance Capabilities

- Sheath temperatures to 1600º F (850ºC)
- Watt densities to 40/Sq." in air and when clamped down
- Voltages, 120, 208, 240, 480 and 550V
- Resistant to shock, vibration and corrosion

Straight Tubular Ordering Information

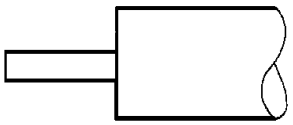
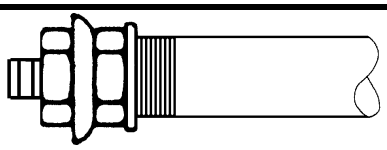
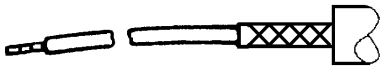
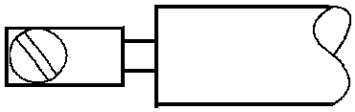
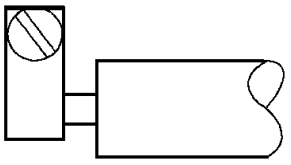
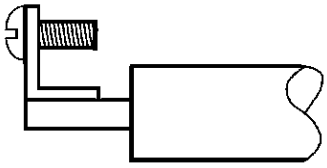
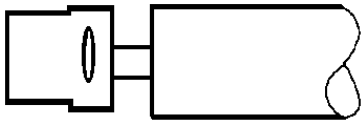
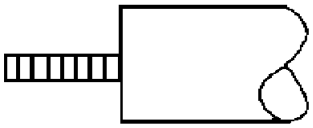
Order Code Example: T142102NS01



FRACTION	CODE
1/32	01
1/16	02
1/8	04
1/4	08
1/2	16
5/8	20
3/4	24

*Assigned at the time of manufacturing
**N =Incoloy, S =Stainless Steel, C =Copper, T =Steel

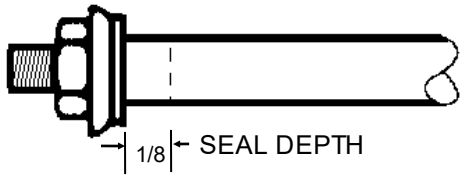
Terminations and Styles

TYPE	DESCRIPTION	SIZE	TUBE DIA.	
A	**Plain pin** *Specify length of pin.*	*.062* *.093* *.135* *.150*	*.165* *.263* *.315* *.440*	
B	**Threaded** *Screw and nut arrangement. Can be supplied with mica washer or ceramic insulator.*	*6-32* *8-32* *10-32*	*.263* *.315* *.440*	
C	**Lead wire** *STRANDEDS TGGT is standard specify length. Other leads available check factory.*	*Wire size by amps.*	*.165 and up*	
D	**Screw lug straight** *Supplied with binding head screw straight out.*	*10-32*	*All Dia*	
E	**Screw lug right angle** *Supplied with binding head screw at right angle.*	*10-32*	*All Dia*	
F	**Screw lug--welded rt. angle** *For ease of host up screw is placed at rt. angle and welded in place*	*10-32*	*All-Dia*	
G	**Quick disconnect tab** *Supplied with standard 1/4" tab for quick connections*	*1/4 x 1/2*	*.165 UP*	
H	*Threaded Terminal* *Specify length.*	*Use TypeB* *6-32* *8-32* *10-32*	 *.263* *.315* *.440.*	

Terminations and Styles

TYPE J

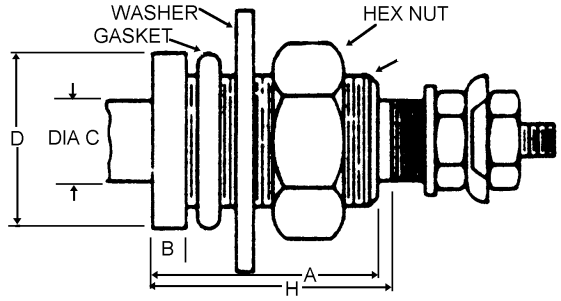
SILICONE RUBBER OR EPOXY SEAL



Provides good seal against moisture and contamination.
Seal is approximately 1/8" deep.
RTV rated to 450°F.
Epoxy rated to 250°F.

TYPE K

BULKHEAD FITTING WATER TIGHT

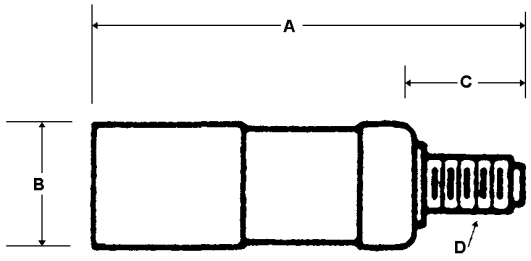


Bushings are available in brass, steel and stainless steel materials. Fittings are silver brazed or Heliarc welded to sheath. Standard bushing comes complete with non-asbestos fiber gasket, plated steel washer, and jam nut. Specify stainless steel if needed. Standard bushing sizes are shown in the table. Other sizes are also available.

TUBE DIA C	A	B	THREAD	D	MAX H	WASHER DIA	NUT ACROSS FLAT
.260	1 5/16	3/16	3/8-24	5/8	1 9/16	13/16	9/16
.315	1 5/16	3/16	1/2-20	3/4	1 9/16	1 1/16	3/4
.440	1 5/16	3/16	3/4-16	1	1 9/16	1 1/2	1 1/8

TYPE L

CERAMIC TO METAL END SEAL



Ceramic to metal end termination This provides an air tight seal for continuous terminal temperature to 500°F MAX.

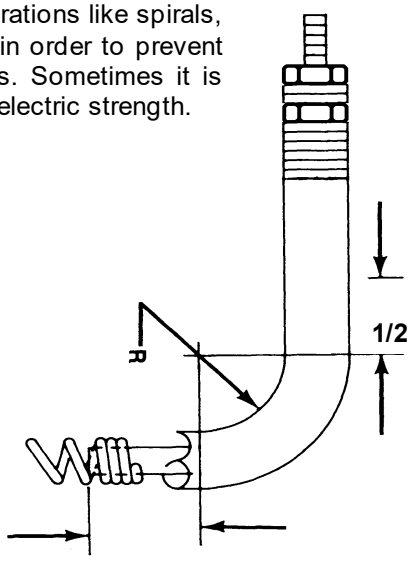
TUBE DIA	A	B	C	D
.315	1 15/16	23/64	11/16	10-32
.440	2 1/8	31/64	11/16	1/4-28

Comprehensive Bending Guide

Tubular heaters when fully annealed can be formed to virtually into any configurations like spirals, compounds, multi-axis and multi-planes. Bending guidance must be observed in order to prevent the sheath from breaking during bending or developing stress cracking marks. Sometimes it is necessary to recompact bend areas to restore the insulation density to regain dielectric strength.

SHEATH DIA.	FIELD BOND RADIUS	FACTORY BOND RADIUS	*MINIMUM STRAIGHT
.260	3/4"	3/8"	1/2"
.315	1"	1/2"	1/2"
.375	2"	9/16"	5/8"
.430	2½"	3/4"	3/4"
.490	2½"	1"	1"

*Length required before bending

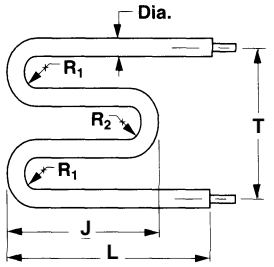


1/2

CAUTION: Never make bends within a minimum of 1/2" of the internal junction of the terminal pin i.e. from cold section and the resistance wire meaning the heating section. Bending in above junction areas can split the sheath open or short the element to ground. To order a common bend formations specify the bend figure number dimensions and tolerances.

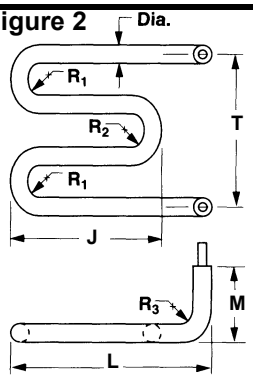
TYPICAL BEND FORMATIONS

Figure 1



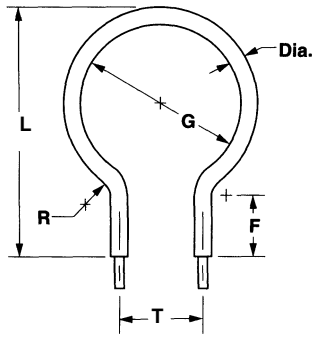
Sheath Length = 2L+2.28R1 -1.29 Dia.+2J +1.14R2
No. of bends = 3

Figure 2



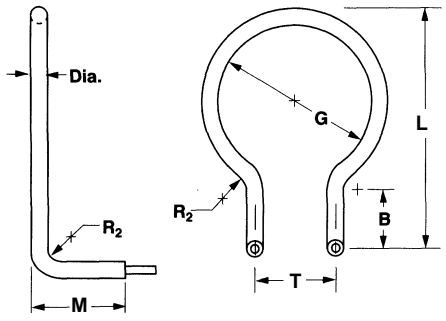
Sheath Length = 2M-0.86R3-3.72 Dia.+2L+2J+2.28R1 +1.14R2
No. of bends = 5

Figure 3



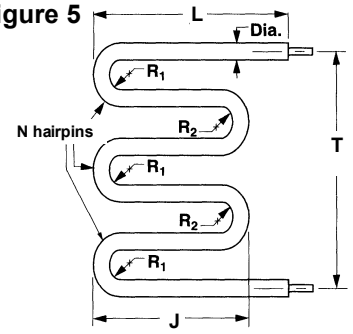
Sheath Length = (G + Dia.)3.14+ 1.14R+2F+3.71 Dia.-T
No. of bends = 4

Figure 4



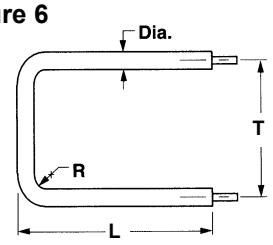
Sheath Length = (G + Dia.)3.14+1.14R1 +2B+1.14R2 +2M+3.28 Dia.-T
No. of bends = 6

Figure 5



Sheath Length = 2L+0.43 Dia.(1-2N)+2J(N-1)+1.14R1 +1.14R2 (N-1)
N= Number of outside hairpins

Figure 6

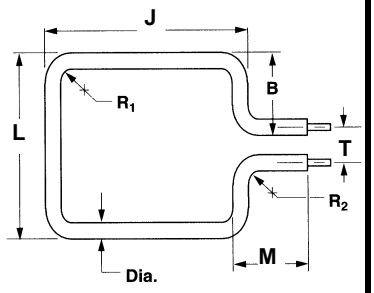


Sheath Length = 2L-0.86R-1.43 Dia.+T
No. of Bends = 2

	No. of bends = 5	

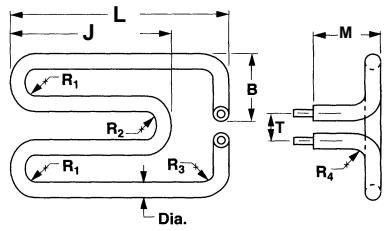
Typical Bend Formations

Figure 7



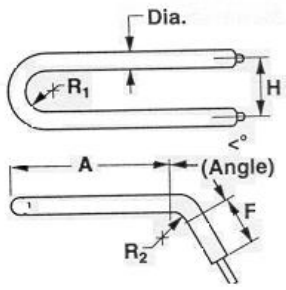
Sheath Length = 2M+2L+2J-T-1.72R1-0.86R2 -6.29 Dia
No. of bends = 6

Figure 8



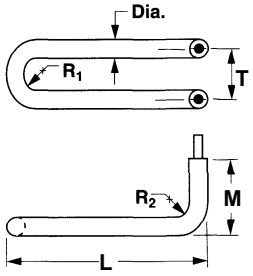
Sheath Length=2M+2L+2J+2.28R1+ 1.14R2 +2B-6.15 Dia -0.86R3 +0.86R4
No. of bends = 7

Figure 9



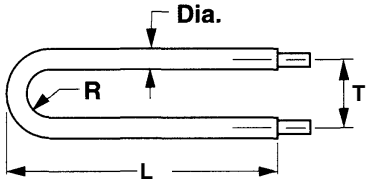
Sheath Length = 2A+2F+1.14R1 +0.0175(<°)(2R2+Dia.)-0.43Dia.
No. of bends = 3

Figure 10



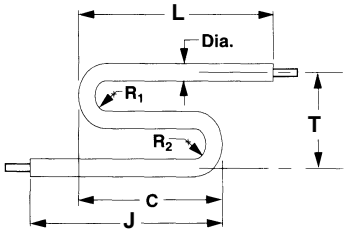
heath Length = 2M -0.86R2 -2.86Dia.+2L + 1.14R1
No. of bends = 3

Figure 11



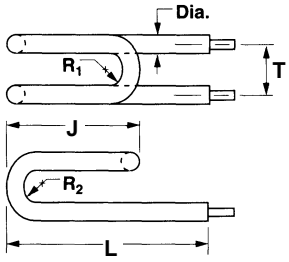
Sheath Length = 2L+ 1.14R-0.43 Dia.
No. of bends = 1

Figure 12



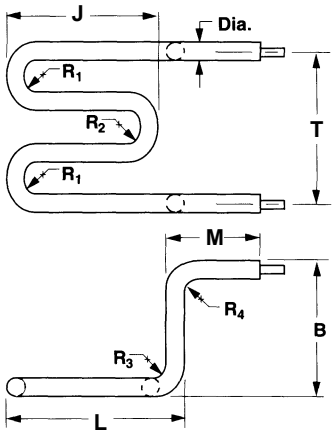
Sheath Length=J+1.14R2 -0.86 Dia.+C+1.14R1+ L
No. of bends = 2

Figure 13



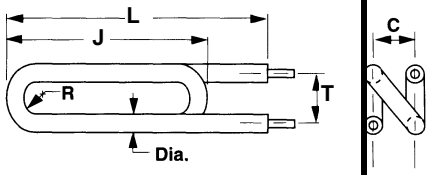
Sheath Length - 2L+2.28R2 -1.29 Dia.+2J+1.14R1
No. of bends = 3

Figure 14



Sheath Length = 2M-0.86R3-0.86R4-6.15 Dia.+2B+2L+2J+2.28R1 +1.14R2
No. of bends = 7

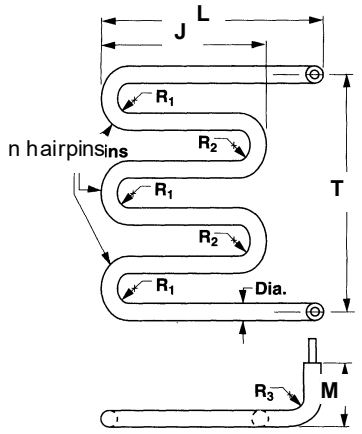
Figure 15



Sheath Length=2L+3.42R-1.29 Dia. +2L
No. of bends =5

Typical Bend Formations

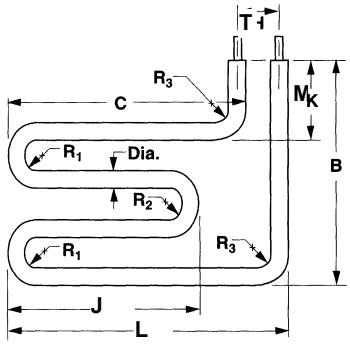
Figure 16



Sheath Length = 1.14R_2 N-0.88 Dia N-.14R_2 -2 Dia.+1.14R_1 N-0.86R_3+2J N-2J+2L +2M
N = number of outside hairpins

No of bends = 7

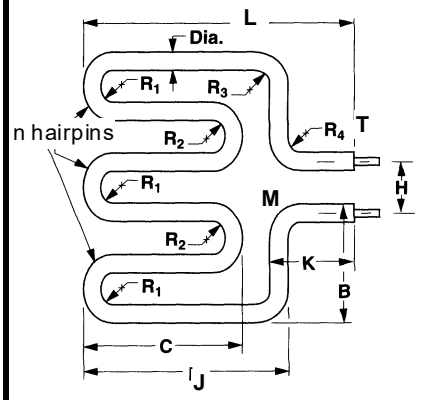
Figure 17



Sheath Length = 2B+2L=2J-6.717 Dia. -1.717R_1-H-0.858R_2-0.858R_3

No of bends = 5

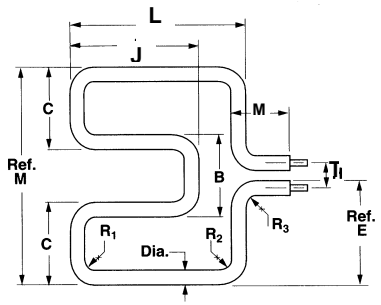
Figure 18



Sheath Length = 2J+2K+2B+2C(N-1)-0.86R_3-0.86R_4 -4.86 Dia. +1.14R_1 (N) +1.14R_2 (N-1) -(2N-1)0.43 Dia.

No of bends = 9

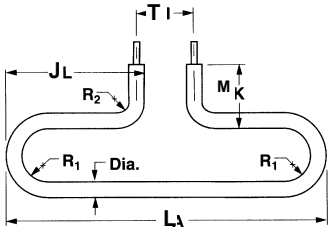
Figure 19



Sheath Length =2M+2C+B+2L+2J -2.58R_1-0.86R_2-0.86R_3-12.15 Dia.

No of bends =10

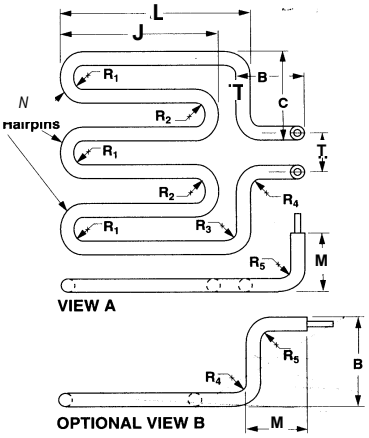
Figure 20



Sheath Length=2L+2M-T-2.28R_1 -0.86R_2-3.29 Dia.

No of bends=4

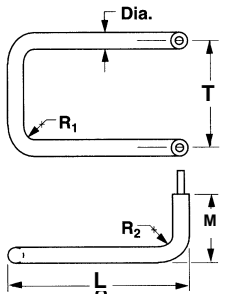
Figure 21



Sheath Length=2M+2L+2B+2C +2J(N-1) +1.14R_1 (N)+1.14R_2 (N-1)-0.86R_3-0.86R_4 -0.86R_5-7.29 Dia. - (2N-1)0.43 Dia.
N= number of outside hairpins
No of bends=11

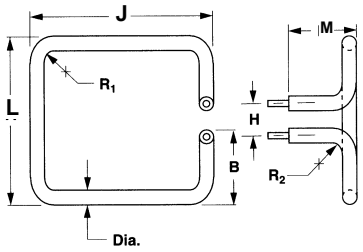
Typical Bend Formations

Figure 22



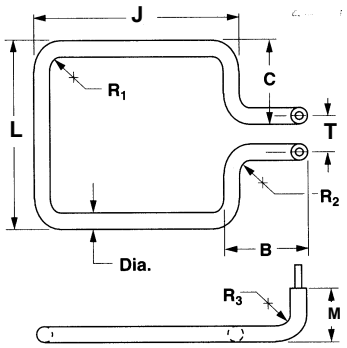
Sheath Length = 2M - 0.86R_2-3.86 Dia. 2L-0.86R_1+T
No of bends = 4

Figure 23



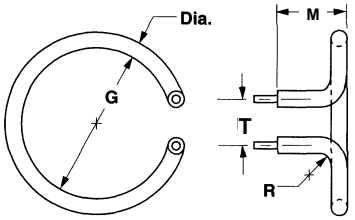
Sheath Length=2M+2L+2J-H -1.72R_1 -0.86R_2 -6.92 Dia.
No of bends = 6

Figure 24



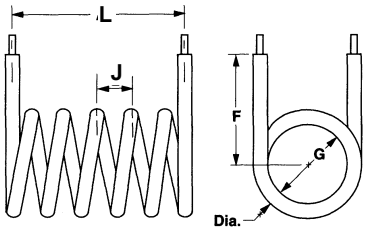
Sheath Length=2M+2L+2J+2B-T-1.72R_1-1.72R_2-8.72 Dia
No of bends = 8

Figure 25



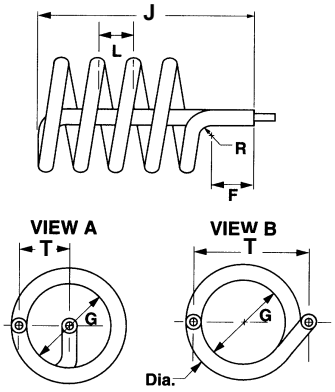
Sheath Length =(G+Dia.)3.14+ 1.14R+2M+3.28 Dia-T
No of bends = 4

Figure 26



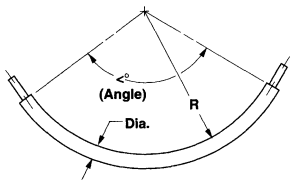
Sheath Length = [(G+Dia.) (3.14)(Number of 360º's)]+2F

Figure 27



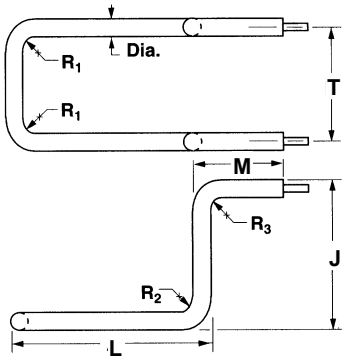
Sheath Length = [(G+Dia.) (3.14) (Number of 360º's)]+(G÷2)+J+F

Figure 28



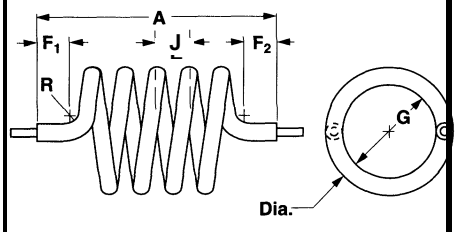
Sheath Length = 0.0175 <º (R+0.5 Dia)
No of bends = 1

Figure 29



Sheath Length = 2M+2J+T-.86$R_1$0.86R_2-0.86R_3-7.29 Dia.
No of bends = 6

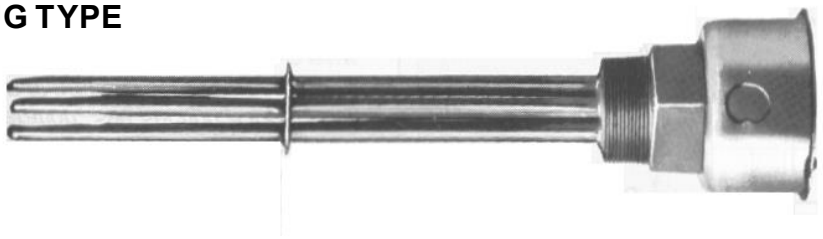
Figure 30



Sheath Length=[(G+Dia.)(3.14) (Number of 360º's)]+F1+F2

Tubular Immersion Heater

SCREW PLUG TYPE



Screw plug heaters are used for heating liquids and gases in a variety of processes. Basically hairpin bend tubular elements are welded or brazed into a screw plug. Terminals and electrical connectors are provided in a box. Heaters with built-in thermostat have a thermowell i.e. a hollow tube sealed at one end which is welded or brazed to the screw plug. A temperature sensing thermostat bulb can be inserted in the tube without the necessity of draining liquid.

Application

Sheath materials used for heating various liquids and solutions are copper, stainless steel, steel and Incoloy.

Typical Sheath Applications

- Air and gas flow
- Anti-Freeze (Glycol) Solutions
- Caustic Solutions
- Chemical Baths
- Hydraulic oil, crude oil and asphalt
- Industrial water rinse tanks
- Lubricating oils at API specified watt densities
- Paraffin
- Vapor Degreasers
- Water:
  Deionized
  Demineralized
  Clean
  Process

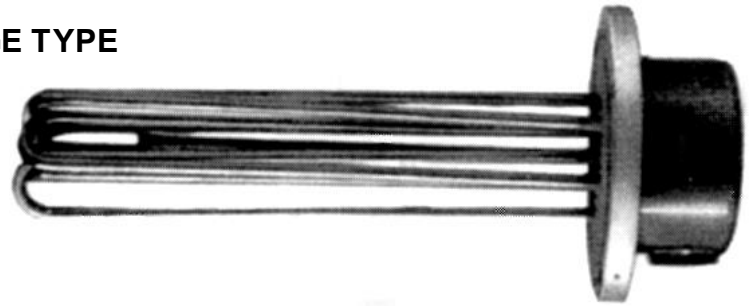
Features

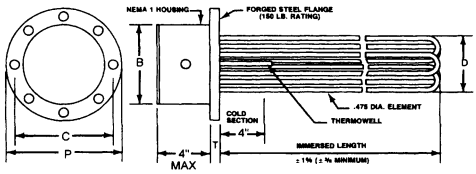
- Watt densities to 100 W/Sq. In.
- Integral thermowell for thermostat bulb
- Nema standard housing
- Corrosion resistant hardware
- Stainless Steel, Steel, Incoloy and Copper Sheath materials
- Compacted hairpin bends
- Brass, Stainless Steel and Steel screw plugs

APPLICATION	SCREW PLUG SIZE	SHEATH MATERIAL	SCREW PLUG MATERIAL
Clean Water	*1”*	*Copper*	*Brass*
	1¼”	*Copper*	*Brass*
	2”	*Copper*	*Brass*
	2”	*Incoloy*	*Brass*
	2½”	*Copper*	*Brass*
	2½”	*Copper*	*Brass*
Process Water	*1”*	*SS*	*SS*
	2”	*SS*	*SS*
	2½”	*SS*	*SS*
Solution Water	*2”*	*Incoloy*	*SS*
	2½”	*Incoloy*	*SS*
Light weight oil	*1”*	*Steel*	*Steel*
	1¼”	*Steel*	*Steel*
	2”	*Steel*	*Steel*
	2½”	*Steel*	*Steel*
Medium weight oil	*2”*	*Steel*	*Steel*
	2½”	*Steel*	*Steel*
Heavy weight oil	*2”*	*Steel*	*Steel*
	2½	*Steel*	*Steel*
	1/2”	*Incoloy*	*Steel*
	1/2”	*SS*	*Steel*
	1/2”	*Incoloy*	*Brass*
	1/2”	*SS*	*Brass*
	1/2”	*SS*	*SS*
	3/4”	*Incoloy*	*Steel*
	3/4”	*SS*	*Steel*
	3/4”	*Incoloy*	*Brass*
Specialty Heaters oil and corrosion fluids	*3/4”*	*SS*	*Brass*
	1”	*Copper*	*Brass*
	1”	*SS*	*SS*
	1”	*Steel*	*Steel*
	1”	*Incoloy*	*Brass*
	1¼”	*Copper*	*Brass*
	2”	*Incoloy*	*Brass*

Tubular Immersion Heater

FLANGE TYPE





AKINSUN offers a broad range of flanged immersion heaters to solve your industrial problems. Flange heaters are used for heating liquids and gases in a variety of processes. Basically hairpin bend tubular elements are welded or brazed into a flange. Terminals and electrical connectors are provided in a box. Heaters with built-in thermostat have a thermowell i.e. a hollow tube sealed at one end which is welded or brazed to the screw plug.
A temperature sensing thermostat bulb can be inserted in the tube without the necessity of draining liquid. Standard wattages are available. Elements are constructed from either copper, steel, stainless steel or Incoloy for heating of water, oil or corrosive liquids. Many models of immersion heaters can be adapted with thermostats for temperature control or to act as high limit switches.

DIMENSION IN INCHES

PIPE SIZE	NO OF ELEMENTS	FLANGE DIMENSIONS T	C	P	FLANGE HOLE SIZE	NO OF HOLES	D	B
3	3	1 5/16	6	7 1/2	3/4	4	4 1/2	2 3/4
5	6	1 5/16	8 1/2	10	7/8	8	6 3/4	5
6	12	1	9 1/2	11	7/8	8	7 3/4	6
8	18	1 1/8	11 3/4	13 1/2	7/8	8	9 1/4	7 13/16
10	27	1 3/16	14 1/4	16	1	12	12 1/4	9 3/4
12	36	1 1/4	17	19	1	12	15	11 3/4
14	45	1 3/8	18 3/4	21	1 1/8	12	16 1/2	12 3/4

Applications

- Vapor Degreasers
- Anti-Freeze(Glycol) solutions
- Caustic solutions
- Lubrication oils API specified watt densities
- Air and gas flow
- Hydraulic oil, crude oil and asphalt
- Chemical baths
- Industrial water rinse tanks
- Paraffin

Features

- Watt densities to 100 W/Sq.In.
- Flange size to 14 inches
- Tapped holes in flange facilitate lifting the heater
- Integral Thermowell for thermostat bulb
- Compacted hairpin bends
- Stainless Steel, Steel, Incoloy and Copper Sheath materials
- Nema standard housing
- Corrosion resistant hardware

Ordering Information

Order Code Example: X1424CA01 — X 1424 C A 01

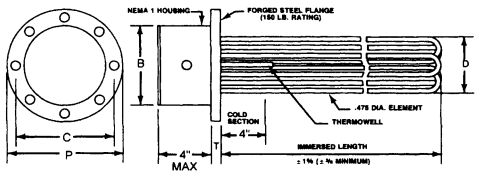
- Flange Type — X
- Length 14 ¾” — 1424
- Sheath Mat’l. Copper** — C
- 3” Pipe — A
- Manufacturing code* — 01

FRACTION	CODE
1/32	01
1/16	02
1/8	04
1/4	08
1/2	16
5/8	20
3/4	24

** N = Incoloy, S = Stainless Steel, C = Copper, T = Steel

* Assigned at the time of manufacturing

Flange Type



STANDARD SIZES AND RATING (Dimensions in inches)

PIPE FLANGE SIZE	LENGTH	KW	240V- 1 PHASE	240V- 3 PHASE	480V- 1 PHASE	480V-3 PHASE
3"	*14 3/4*	*6*	*X1424CA01*	*X1424CA02*	*X1424CA03*	*X1424CA04*
COPPER	*21*	*9*	*X2100CA01*	*X2100CA02*	*X2100CA03*	*X2100CA04*
SHEATH	*27 1/8*	*12*	*X2704CA01*	*X2704CA02*	*X2704CA03*	*X2704CA04*
60W/SQ. IN.	*39 1/2*	*18*	*X3916CA01*	*X3916CA02*	*X3916CA03*	*X3916CA04*
3"	*21*	*3*	*X2100TA01*	*X2100TA02*	*X2100TA03*	*X2100TA04*
STEEL	*30 1/4*	*4.5*	*X3008TA01*	*X3008TA02*	*X3008TA03*	*X3008TA04*
SHEATH	*48 11/16*	*7.5*	*X4822TA01*	*X4822TA02*	*X4822TA03*	*X4822TA04*
20W/SQ. IN.	*58*	*9.0*	*X5800TA01*	*X5800TA02*	*X5800TA03*	*X5800TA04*
5"	*14 11/16*	*12*	*X1422CB01*	*X1422CB02*	*X1422CB03*	*X1422CB04*
COPPER	*21*	*18*	*X2100CB01*	*X2100CB02*	*X2100CB03*	*X2100CB04*
SHEATH	*33 1/4*	*30*	*X3308CB01*	*X3308CB02*	*X3308CB03*	*X3308CB04*
60W/SQ. IN.	*54*	*50*	*X5400CB01*	*X5400CB02*	*X5400CB03*	*X5400CB04*
5"	*21*	*6*	*X2100TB01*	*X2100TB02*	*X2100TB03*	*X2100TB04*
STEEL	*30 1/4*	*9*	*X3008TB01*	*X3008TB02*	*X3008TB03*	*X3008TB04*
SHEATH	*48 3/4*	*15*	*X4824TB01*	*X4824TB02*	*X4824TB03*	*X4824TB04*
20W/SQ. IN.	*79 1/2*	*25*	*X7916TB01*	*X7916TB02*	*X7916TB03*	*X7916TB04*
6"	*27 1/8*	*48*	*X2704CC01*	*X2704CC02*	*X2704CC03*	*X2704CC04*
COPPER SHEATH	*33 1/4*	*60*	*X3308CC01*	*X3308CC02*	*X3308CC03*	*X3308CC04*
60W/SQ. IN.	*39 3/8*	*72*	*X3912CC01*	*X3912CC02*	*X3912CC03*	*X3912CC04*
6"	*30 1/8*	*18*	*X3008TC01*	*X3008TC02*	*X3008TC03*	*X3008TC04*
STEEL SHEATH	*39 3/8*	*24*	*X3912TC01*	*X3912TC02*	*X3912TC03*	*X3912TC04*
20W/SQ. IN.	*48 9/16*	*30*	*X4818TC01*	*X4818TC02*	*X4818TC03*	*X4818TC04*
8"	*21 3/8*	*50*	*X2112CD01*	*X2112CD02*	*X2112CD03*	*X2112CD04*
COPPER SHEATH	*30*	*75*	*X3000CD01*	*X3000CD02*	*X3000CD03*	*X3000CD04*
60W/SQ. IN.	*55 5/8*	*150*	*X5520CD01*	*X5520CD02*	*X5520CD03*	*X5520CD04*
8"	*35 1/8*	*30*	*X3504TD01*	*X3504TD02*	*X3504TD03*	*X3504TD04*
STEEL SHEATH	*45 3/8*	*43*	*X4512TD01*	*X4512TD02*	*X4512TD03*	*X4512TD04*
20 W/SQ. IN.	*66*	*60*	*X6600TD01*	*X6600TD02*	*X6600TD03*	*X6600TD04*
10"	*35 1/8*	*45*	*X3504TE01*	*X3504TE02*	*X3504TE03*	*X3504TE04*
STEEL SHEATH	*45 3/8*	*60*	*X4512TE01*	*X4512TE02*	*X4512TE03*	*X4512TE04*
20W/SQ. IN.	*66*	*75*	*X6600TE01*	*X6600TE02*	*X6600TE03*	*X6600TE04*
12"	*35 1/8*	*60*	*X3504TF01*	*X3504TF02*	*X3504TF03*	*X3504TF04*
STEEL SHEATH	*45 3/8*	*80*	*X4412TF01*	*X4412TF02*	*X4412TF03*	*X4412TF04*
20W/SQ. IN.	*66*	*100*	*X6600TF01*	*X6600TF02*	*X6600TF03*	*X6600TF04*
14"	*35*	*75*	*X3500TG01*	*X3500TG02*	*X3500TG03*	*X3500TG04*
STEEL SHEATH	*45*	*100*	*X4500TG01*	*X4500TG02*	*X4500TG03*	*X4500TG04*
20W/SQ.IN	*55 1/2*	*125*	*X5516TG01*	*X5516TG02*	*X5516TG03*	*X5516TG04*

* Moisture and explosion resistant terminal box
* Incoloy and Stainless Steel elements available
* Special length Wattage and Voltage available
* 300 Lb. flanges available upon request

For ordering information see page F11